

**July 26, 2013**

**Summary Report of  
Texas Department of State Health Services Investigation of  
Specific Cancers Occurrences  
Within Combined Zip Codes 75204, 75206, 75214, & 75246, Dallas  
Dallas County, Texas  
Covering 2001–2010**

**Background**

Concern about a possible excess of cancer diagnoses prompted the Texas Department of State Health Services (DSHS) to examine the occurrence of cancer in combined zip codes 75204, 75206, 75214, and 75246, Dallas, Texas. Local citizens were concerned that unknown toxic chemicals from their drinking water pipes may be causing cancer. DSHS evaluated 2001–2010 incidence data for cancers of the liver and intrahepatic bile duct, brain and other nervous system (brain/CNS), other nervous system, non-Hodgkin’s lymphoma, Hodgkin’s lymphoma, and select leukemia subtypes.

For this investigation DSHS used cancer incidence data which shows the number and types of cancer diagnosed each year. Cancer incidence data are the best indicator of cancer occurrence and cancer incidence data for Texas currently meet national standards for timeliness and data quality. This report presents information on methods used to conduct this investigation, the results, recommendations, and general information on cancer risk factors.

**Investigation Methodology**

According to the National Cancer Institute (NCI), a cancer cluster is a greater than expected number of cancers among people who live or work in the same area and who develop or die from the same cancer within a short time of each other. A cancer cluster investigation is designed with the specific intention of addressing the question, “Is there more cancer in the area or population of concern than we would expect?” While these types of investigations can be used to investigate whether the amount of cancer in a community is more than expected, they cannot determine either the cause of the cancers or possible associations with any risk factors.

DSHS follows guidelines recommended by the federal Centers for Disease Control and Prevention (CDC) for investigating cancer clusters.<sup>1</sup> If DSHS finds more cancer than expected or if rare or unlikely cancers are found in unusual age groups, various factors are considered to determine whether further study could identify a likely cause. Very few cancer cluster investigations in the United States proceed to this stage.

To determine whether a statistically significant excess of cancer existed in the geographic

areas of concern, the number of observed cases was compared to what would be "expected" by applying state cancer rates to the average of the 2000 and 2010 Census population data for the area under investigation. Calculating the expected number(s) of cancer cases takes into consideration the race, sex, and ages of those who are diagnosed with cancer. This is important because all of these factors can impact cancer rates. When trying to determine if there is more or less cancer in a community compared to the rest of Texas, an investigation must ensure that differences in cancer rates are not simply due to differences in population demographics. Since a higher than expected number of cancer cases in a community can occur by chance alone, the role of chance also is considered in the statistical analysis.

Attached tables (Table 1-4) present the number of observed cases for males and females; number of "expected" cases; standardized incidence ratio (SIR); and corresponding 99% confidence interval. The SIR is simply the number of observed cases divided by the number of "expected" cases. When the SIR of a selected cancer is equal to 1.0, then the number of observed cases is equal to the expected number of cases, based on incidence rates in the state. When the SIR for a particular cancer is less than 1.0, there are fewer cases of that type of cancer in the area than would be expected. Conversely, an SIR greater than 1.0 indicates that there are more cases of a specific type of cancer in the area than would be expected.

Since an excess of cancer can occur by chance alone, statistics are used in the analysis to calculate the 99% confidence intervals to determine the likelihood that the resultant SIR (whether it is greater or lower than 1.0) is due to chance. A 99% confidence interval provides a range that we would expect the SIR to fall 99% of the time. If the confidence interval for a specific SIR includes 1.0, the result is not statistically significant and the observed number of cases is within the range not considered to be different than the expected number of cases. Confidence intervals are particularly important when trying to interpret small numbers of cases. Wide confidence intervals, which are common when dealing with small populations and small numbers of cases, reflect a greater uncertainty in the results. For instance, if only one or two cases are expected, three or four observed cases will result in a very large SIR. A more extreme example would be when due to the small size of the population the expected number of cases is less than 1.0; in this instance one observed case can result in a very high SIR. As long as the 99% confidence interval contains 1.0, the SIR is still within the expected range and therefore is not statistically significant.

### **Investigation Results**

From January 1, 2001 to December 31, 2010, the number of cancers of the brain/CNS, other nervous system, non-Hodgkin's lymphoma, Hodgkin's lymphoma, and select leukemia subtypes were within the expected range in both males and females in combined zip codes 75204, 75206, 75214, & 75246, Dallas, Texas. Liver and intrahepatic bile duct cancer in males was found to be statistically significantly elevated in the combined zip codes (SIR=1.6) and in zip code 75204 (SIR=2.6). Analysis summaries are presented in Tables 1-4.

### **Discussion**

We do not know why male liver cancer was elevated in the combined Dallas zip codes, nor may we ever know why. Determining the cause of any excess is beyond the scope of the cancer cluster investigation. However, part of any cancer cluster investigation is to evaluate if further study is recommended to determine if a particular environmental exposure may be associated with an observed cancer excess. Liver cancer when analyzed by single zip code (Table 3-4) was found to be in excess in zip code 75204 males (SIR=2.6) and total 75204 (SIR=2.5). Due to the scientific literature showing that people who have been exposed to arsenic may be at increased risk of liver cancer and since the liver cancer excess was found only in males, the occupations of the male liver cancer cases were examined from their abstracted case reports. However, the occupational data for the combined zip codes were not complete enough to evaluate since only 16 of 65 had any occupation listed. The male liver cancer cases when analyzed by age group were found to be concentrated toward older age groups as expected with none diagnosed before the age of 40. Additional review of the male liver cancer cases also indicated 3 of 65 cases were identified from only death certificates. Death certificate only cases are more likely to indicate liver cancer when the liver cancer is actually a metastatic site rather than the original primary cancer site. Information on other possible liver cancer risk factors such as alcohol use (cirrhosis), hepatitis infection, aflatoxin ingestion, or exposures to chemicals are not collected or available for analysis. Distribution of the male liver cancer cases by year identified no unusual patterns.

Like other studies, this cancer cluster investigation had limitations. The incidence data used in the cluster analysis did not include data for the most recent years. Also, cancer incidence data are based on residence at the time of diagnosis. It is possible that some residents who developed cancer no longer lived in the area at the time of diagnosis, so were not included in the analyses. However, it is also possible that people may have moved into the area and then developed cancer because of an exposure from a prior residential location or other factors. These cases are included in the investigation.

### **Recommendations**

Because there is an established link between arsenic and liver cancer in laboratory animals, we will update this investigation for liver cancers in zip codes 75204, 75206, 75214, & 75246 when new information or data become available.

### **Information on Cancer and Cancer Risk Factors:**

Overall, the occurrence of cancer is common, with approximately two out of every five persons alive today predicted to develop some type of cancer in their lifetime.<sup>2</sup> In Texas, as in the United States, cancer is the leading cause of death for people under the age of 85.<sup>3</sup> Also, cancer is not one disease, but many different diseases. Different types of cancer are generally thought to have different causes. If a person develops cancer, it is probably not due to one factor but to a combination of factors such as heredity; diet, tobacco use, and other lifestyle factors; infectious agents; chemical exposures; and radiation exposures. Although cancer may impact individuals of all ages, it primarily is a disease of older persons with over one-half of cancer cases and two-thirds of cancer deaths occurring in persons 65 and older. Finally, it takes time for cancer to develop, between 10–40 years can go by between the exposure to a carcinogen and a diagnosis of cancer.<sup>4</sup>

The chances of a person developing cancer as a result of exposure to an environmental contaminant are slight. Most experts agree that exposure to pollution, occupational, and industrial hazards account for fewer than 10% of cancer cases.<sup>5</sup> The Harvard Center for Cancer Prevention estimates 5% of cancer deaths are due to occupational factors, 2% to environmental pollution and 2% to ionizing/ultraviolet radiation.<sup>6</sup> In contrast, the National Cancer Institute estimates that lifestyle factors such as tobacco use and diet cause 50 to 75 percent of cancer deaths.<sup>7</sup> Eating a healthy diet and refraining from tobacco are the best ways to prevent many kinds of cancer. It is estimated that one-third of all cancer deaths in this country could be prevented by eliminating the use of tobacco products. Additionally, about 25 to 30 percent of the cases of several major cancers are thought to be associated with obesity and physical inactivity.<sup>8</sup>

### **Known Risk Factors for Cancers Examined in This Investigation:**

The following is a brief discussion summarized from the American Cancer Society and the National Cancer Institute about cancer risk factors for the specific cancers studied in this investigation.<sup>9,10</sup>

The occurrence of cancer may vary by race/ethnicity, gender, type of cancer, geographic location, population group, and a variety of other factors. Scientific studies have identified a number of factors for various cancers that may increase an individual's risk of developing a specific type of cancer. These factors are known as risk factors. Some risk factors individuals can do nothing about, but many are a matter of choice.

### **Liver and Intrahepatic Bile Duct Cancer**

In contrast to many other types of cancer, the number of people who develop liver cancer and die from it is increasing. This cancer is about 10 times more common in developing countries. The risk factors for liver cancer include viral hepatitis, cirrhosis, long-term exposure to aflatoxin, exposure to vinyl chloride and thorium dioxide, older forms of birth control pills, anabolic steroids, obesity, arsenic in drinking water, tobacco use, bile duct disease, ulcerative colitis, liver fluke infection, and aging. Chemicals that are associated with bile duct cancer include dioxin, nitrosamines, and polychlorinated biphenyls (PCBs).

### **Brain/CNS Cancer**

The large majority of brain cancers are not associated with any risk factor. Most brain cancers simply happen for no apparent reason. A few risk factors associated with brain cancer are known and include radiation treatment, occupational exposure to vinyl chloride, immune system disorders, and family history of brain and spinal cord cancers. Some population-based studies have suggested a possible increased risk of brain tumors with cell phone use, but most of the larger studies to date have not found an increased risk, either overall or among specific types of tumors. There are very few studies of long-term use (10 years or more), and cell phones haven't been around long enough to determine the possible

risks of lifetime use.

### **Non-Hodgkin's Lymphoma**

Risk factors for non-Hodgkin's lymphoma include infection with *Helicobacter pylori*, human immunodeficiency virus (HIV), human T-cell leukemia/lymphoma virus (HTVL-1), or the Epstein-Barr virus and malaria. Other possible risk factors include obesity, aging, certain genetic diseases, radiation exposure, immuno-suppressant drugs after organ transplantation, benzene exposure, the drug Dilantin, exposure to certain pesticides, a diet high in meats or fat, or certain chemotherapy drugs.

### **Acute Lymphocytic Leukemia (ALL):**

Possible risk factors for ALL include the following: being male, being white, being older than 70 years of age, past treatment with chemotherapy or radiation therapy, exposure to atomic bomb radiation, or having a certain genetic disorder such as Down syndrome.

### **Chronic Lymphocytic Leukemia (CLL):**

Possible risk factors for CLL include the following: being middle-aged or older, male, or white; a family history of CLL or cancer of the lymph system; having relatives who are Russian Jews or Eastern European Jews; or having exposure to herbicides or insecticides including Agent Orange, an herbicide used during the Vietnam War.

### **Acute Myeloid Leukemia (AML):**

Possible risk factors for AML include the following: being male; smoking, especially after age 60; treatment with chemotherapy or radiation therapy in the past; treatment for childhood ALL in the past; being exposed to atomic bomb radiation or the chemical benzene; or having a history of a blood disorder such as myelodysplastic syndrome.

### **Chronic Myeloid Leukemia (CML):**

Most people with CML have a gene mutation (change) called the Philadelphia chromosome. The Philadelphia chromosome is not passed from parent to child.

For additional information about cancer, visit the "Resources" link on the DSHS Web site at <http://www.dshs.state.tx.us/tcr/>.

Questions or comments regarding this investigation may be directed to Ms. Brenda Mokry, Environmental Epidemiology & Disease Registries Section, at 512-776-3606 or [Brenda.Mokry@dshs.state.tx.us](mailto:Brenda.Mokry@dshs.state.tx.us).

## **References**

1. Guidelines for Investigating Clusters of Health Events, Centers for Disease Control and Prevention, MMWR 1990; 39 (RR-11): 1-16.
2. American Cancer Society Website: <http://www.cancer.org/cancer/cancerbasics/what-is-cancer>. Retrieved 06/10/13.
3. Cancer Statistics, 2005. CA, Cancer Journal for Clinicians. 2005; 55:10-30. Available online: <http://onlinelibrary.wiley.com/doi/10.3322/canjclin.55.1.10/abstract>. Retrieved 06/10/13.
4. National Cancer Institute Website: <http://www.cancer.gov/cancertopics/factsheet/Risk/clusters>. Retrieved 06/10/13.
5. Cancer: What Causes It, What Doesn't. Published by the American Cancer Society, 2003. Available at the American Cancer Society Website: [http://acs.bookstore.ipgbook.com/cancer--what-causes-it--what-doesn-t-products-9780944235447.php?page\\_id=32&pid=ACN](http://acs.bookstore.ipgbook.com/cancer--what-causes-it--what-doesn-t-products-9780944235447.php?page_id=32&pid=ACN).
6. Harvard Reports on Cancer Prevention. Harvard Center for Cancer Prevention. Volume 1: Human Causes of Cancer. Harvard School of Public Health Website: [http://www.health.harvard.edu/newsletters/Harvard\\_Mens\\_Health\\_Watch/2009/April/Th-10-commandments-of-cancer-prevention](http://www.health.harvard.edu/newsletters/Harvard_Mens_Health_Watch/2009/April/Th-10-commandments-of-cancer-prevention).
7. Cancer Trends Progress Report – 2005 Update. National Cancer Institute Website: <http://progressreport.cancer.gov/2005/doc.asp?pid=1&did=2005&mid=vcol&chid=21>.
8. Cancer and the Environment. Published by the National Cancer Institute (NCI) and the National Institute on Environmental Health Sciences, 2003. [http://www.niehs.nih.gov/health/materials/cancer\\_and\\_the\\_environment\\_508.pdf](http://www.niehs.nih.gov/health/materials/cancer_and_the_environment_508.pdf).
9. American Cancer Society website. <http://www.cancer.org>. Retrieved 06/10/2013.
10. National Cancer Institute website: <http://www.nci.nih.gov/>. Retrieved 06/10/2013.

**Table 1**  
**Number of Observed and Expected Male Cancer Cases and Adjusted Standardized Incidence Ratios, Selected Cancers, Combined Zip Codes 75204, 75206, 75214, & 75246, Dallas, TX, 2001–2010<sup>^</sup>**

<b>Males</b>				
<b>Site</b>	<b>Observed</b>	<b>Expected</b>	<b>SIR</b>	<b>99% CI</b>
<b>Liver &amp; Intrahepatic Bile Duct</b>	65	40.1	1.6*	1.2 – 2.2
<b>Brain/CNS</b>	39	32.6	1.2	0.8 – 1.8
<b>Other Nervous System</b>	3	2.1	1.4	0.2 – 5.2
<b>Hodgkin’s Lymphoma</b>	21	15.8	1.3	0.7 – 2.3
<b>Non-Hodgkin’s Lymphoma</b>	77	76.9	1.0	0.7 – 1.3
<b>Acute Lymphocytic Leukemia</b>	7	8.5	0.8	0.2 – 2.0
<b>Chronic Lymphocytic Leukemia</b>	23	19.3	1.2	0.7 – 2.0
<b>Acute Myeloid Leukemia</b>	17	14.9	1.1	0.6 – 2.1
<b>Chronic Myeloid Leukemia</b>	10	8.2	1.2	0.5 – 2.6
<b>Aleukemic, Subleukemic, &amp; NOS</b>	3	3.1	1.0	0.1 – 3.6

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas during the period 2000–2009. The SIR has been rounded to the first decimal place. Incidence rates for 2000-2009 were used because completeness for 2010 is less than 95% at this time.

\*Significantly higher than expected at the  $p < 0.01$  level.

\*\*Significantly lower than expected at the  $p < 0.01$  level.

<sup>^</sup>The number of cancers diagnosed in 2010 is lower than expected, due to (1) non-reporting of records by military and one Veterans Administration hospital, (2) cancer treatment center reporting delays, and (3) record processing delays related to the conversion to the new TCR software. The number of cases diagnosed in 2010 will increase in next year’s incident file, expected to be available no later than March 2014.

<sup>^</sup>In the 1995-2010 file prepared in April 2013, compared to the 1995-2009 file prepared in February 2012, the number of cases diagnosed in 1995-2003 and 2005 increased by 3%. The primary reason for this change is that, in all previous analysis file, cases reported to the TCR with only a date of admission/first contact and lacking a date of diagnosis, were not included in the analysis file. In contrast, in the 1995-2010 file, date of admission/first contact was used to estimate month and year of diagnosis for those cases, and they were added to the analysis file. Preparations for the conversion to the new TCR software also identified additional multiple primary cases from reports pending processing.

**Table 2**  
**Number of Observed and Expected Female Cancer Cases and Adjusted Standardized Incidence Ratios, Selected Cancers, Combined Zip Codes 75204, 75206, 75214, & 75246, Dallas, TX, 2001–2010<sup>^</sup>**

<b>Females</b>				
<b>Site</b>	<b>Observed</b>	<b>Expected</b>	<b>SIR</b>	<b>99% CI</b>
<b>Liver &amp; Intrahepatic Bile Duct</b>	27	16.6	1.6	0.9 – 2.6
<b>Brain/CNS</b>	18	26.1	0.7	0.3 – 1.2
<b>Other Nervous System</b>	1	2.9	0.3	0.0 – 2.5
<b>Hodgkin’s Lymphoma</b>	14	12.1	1.2	0.5 – 2.2
<b>Non-Hodgkin’s Lymphoma</b>	80	68.6	1.2	0.9 – 1.6
<b>Acute Lymphocytic Leukemia</b>	6	6.2	1.0	0.3 – 2.5
<b>Chronic Lymphocytic Leukemia</b>	14	16.1	0.9	0.4 – 1.7
<b>Acute Myeloid Leukemia</b>	18	13.2	1.4	0.7 – 2.4
<b>Chronic Myeloid Leukemia</b>	6	6.6	0.9	0.2 – 2.4
<b>Aleukemic, Subleukemic, &amp; NOS</b>	2	3.2	0.6	0.0 – 2.9

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas during the period 2000–2009. The SIR has been rounded to the first decimal place. Incidence rates for 2000-2009 were used because completeness for 2010 is less than 95% at this time.

\*Significantly higher than expected at the p< 0.01 level.

\*\*Significantly lower than expected at the p< 0.01 level.

<sup>^</sup>The number of cancers diagnosed in 2010 is lower than expected, due to (1) non-reporting of records by military and one Veterans Administration hospital, (2) cancer treatment center reporting delays, and (3) record processing delays related to the conversion to the new TCR software. The number of cases diagnosed in 2010 will increase in next year’s incident file, expected to be available no later than March 2014.

<sup>^</sup>In the 1995-2010 file prepared in April 2013, compared to the 1995-2009 file prepared in February 2012, the number of cases diagnosed in 1995-2003 and 2005 increased by 3%. The primary reason for this change is that, in all previous analysis file, cases reported to the TCR with only a date of admission/first contact and lacking a date of diagnosis, were not included in the analysis file. In contrast, in the 1995-2010 file, date of admission/first contact was used to estimate month and year of diagnosis for those cases, and they were added to the analysis file. Preparations for the conversion to the new TCR software also identified additional multiple primary cases from reports pending processing.

**Table 3**  
**Number of Observed and Expected Liver Cancer Cases and Adjusted Standardized**  
**Incidence Ratios, Selected Zip Codes, Dallas, TX, 2001–2010<sup>^</sup>**

<b>Males</b>				
<b>Zip Code</b>	<b>Observed</b>	<b>Expected</b>	<b>SIR</b>	<b>99% CI</b>
<b>75204</b>	23	8.8	2.6*	1.4 – 4.4
<b>75206</b>	19	13.4	1.4	0.7 – 2.5
<b>75214</b>	20	15.5	1.3	0.7 – 2.2
<b>75246</b>	3	2.4	1.3	0.1 – 4.6
<b>Females</b>				
<b>Zip Code</b>	<b>Observed</b>	<b>Expected</b>	<b>SIR</b>	<b>99% CI</b>
<b>75204</b>	5	2.8	1.8	0.4 – 5.0
<b>75206</b>	7	5.3	1.3	0.4 – 3.2
<b>75214</b>	13	7.6	1.7	0.7 – 3.4
<b>75246</b>	2	0.9	2.2	0.1 – 10.2

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas during the period 2000–2009. The SIR has been rounded to the first decimal place. Incidence rates for 2000-2009 were used because completeness for 2010 is less than 95% at this time.

\*Significantly higher than expected at the  $p < 0.01$  level.

\*\*Significantly lower than expected at the  $p < 0.01$  level.

<sup>^</sup>The number of cancers diagnosed in 2010 is lower than expected, due to (1) non-reporting of records by military and one Veterans Administration hospital, (2) cancer treatment center reporting delays, and (3) record processing delays related to the conversion to the new TCR software. The number of cases diagnosed in 2010 will increase in next year's incident file, expected to be available no later than March 2014.

<sup>^</sup>In the 1995-2010 file prepared in April 2013, compared to the 1995-2009 file prepared in February 2012, the number of cases diagnosed in 1995-2003 and 2005 increased by 3%. The primary reason for this change is that, in all previous analysis file, cases reported to the TCR with only a date of admission/first contact and lacking a date of diagnosis, were not included in the analysis file. In contrast, in the 1995-2010 file, date of admission/first contact was used to estimate month and year of diagnosis for those cases, and they were added to the analysis file. Preparations for the conversion to the new TCR software also identified additional multiple primary cases from reports pending processing.

**Table 4**  
**Number of Observed and Expected Liver Cancer Cases and Adjusted Standardized**  
**Incidence Ratios, Selected Zip Codes, Dallas, TX, 2001–2010<sup>^</sup>**

<b>Males &amp; Females</b>				
<b>Zip Code</b>	<b>Observed</b>	<b>Expected</b>	<b>SIR</b>	<b>99% CI</b>
<b>75204</b>	28	11.1	2.5*	1.4 – 4.0
<b>75206</b>	26	18.4	1.4	0.8 – 2.3
<b>75214</b>	33	23.4	1.4	0.9 – 2.2
<b>75246</b>	5	3.1	1.6	0.3 – 4.5
<b>Combined Zip Codes</b>	92	56.1	1.6*	1.2 – 2.1

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas during the period 2000–2009. The SIR has been rounded to the first decimal place. Incidence rates for 2000-2009 were used because completeness for 2010 is less than 95% at this time.

\*Significantly higher than expected at the  $p < 0.01$  level.

\*\*Significantly lower than expected at the  $p < 0.01$  level.

<sup>^</sup>The number of cancers diagnosed in 2010 is lower than expected, due to (1) non-reporting of records by military and one Veterans Administration hospital, (2) cancer treatment center reporting delays, and (3) record processing delays related to the conversion to the new TCR software. The number of cases diagnosed in 2010 will increase in next year's incident file, expected to be available no later than March 2014.

<sup>^</sup>In the 1995-2010 file prepared in April 2013, compared to the 1995-2009 file prepared in February 2012, the number of cases diagnosed in 1995-2003 and 2005 increased by 3%. The primary reason for this change is that, in all previous analysis file, cases reported to the TCR with only a date of admission/first contact and lacking a date of diagnosis, were not included in the analysis file. In contrast, in the 1995-2010 file, date of admission/first contact was used to estimate month and year of diagnosis for those cases, and they were added to the analysis file. Preparations for the conversion to the new TCR software also identified additional multiple primary cases from reports pending processing.